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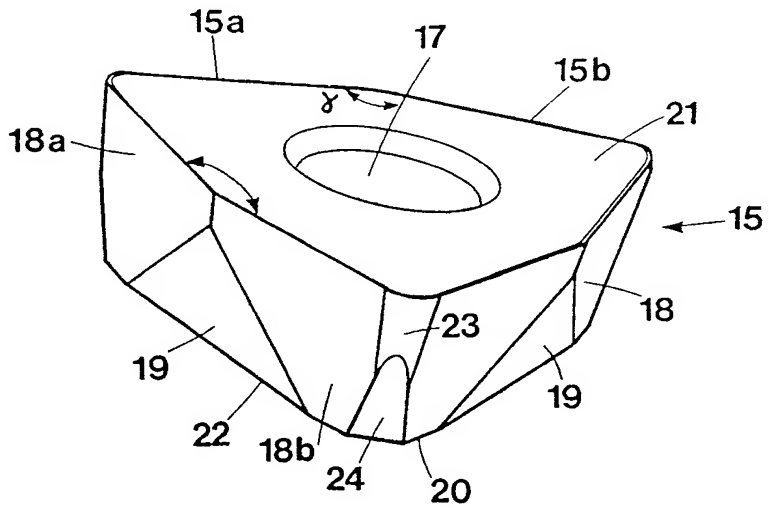
(54) Drill and cutting insert therefor.

(57) The invention relates to a drill for drilling in metal with improved insert location stability. The drill comprises an elongated shaft, the front end of which is provided with radially outer and radially inner inserts (15, 16), each comprising six contiguous edge faces (18) and two opposed hexagonal faces (20, 21) in which each edge surface (18) is provided with a planar land having an angle of inclination (β_2) with the upper hexagonal surface (21) being smaller than the angle of inclination (β_1) between said edge surface (18) and said upper hexagonal surface (21).

Fig.4



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DRILL AND CUTTING INSERT THEREFOR

The present invention is related to a drill for drilling in metal workpieces comprising an elongated drill body, the front end of which is provided with radially outer and inner indexable inserts that together are able to drill a hole in a solid workpiece. The invention also relates to an indexable insert to be used in such drill.

Most current user of so-called short hole drills incorporates the use of a tool support body or holder which carries one or several small indexible carbide inserts which define the cutting edges. These types of tools have been widely accepted for drilling holes the length of which is about 2 to 4 times the diameter of the drilled hole. However, some problems of using this general construction for drilling in steel have been encountered due to the fact that the desirable accurate position of the insert when secured into its insert-receiving location has not always been achieved. Tools capable of performing this general function are shown in U.S. Patent Nos. 4,149,821 and 4,648,760.

Applicant has solved the problems of the prior art by utilizing indexable inserts having six contiguous edge faces of equal length and two hexagonal side faces that can be more accurately positioned into their pockets of a drill shaft. Such drills will be more stable towards anticipated high cutting loads. This improved stability is of importance since the outer cutting edge of a drill insert of this type always has a greater surface speed then the inner edge for a given turning speed of the drill.

The invention will now be more closely described in conjunction with the accompanying drawing, in which

Fig. 1 is an elevational view of the elongated drill,

Fig. 2 is an end view of the drill of Fig. 1,

Fig. 3 is an enlarged cross-sectional view of the insert at its location in an insert-receiving pocket in the drill body,

Fig. 4 is a perspective view of a hexagonal insert of the present invention, and

Fig. 5 is a plan view of the insert of Fig. 4.

Figs. 1-2 show a portion of a cylindrical drill shank 10 which at its foremost part is provided with two insert sites 11, 12 positioned mainly on each side of the center line CL of the drill. Axial flutes or passages for the flow of chips are designated by 13 and 14. Both of the insert sites 11, 12 are centrally provided with holes to receive locking screws (not shown) for locking the inserts 15, 16 in the sites.

The two inserts 15 and 16 are arranged so that they extend axially to same extent and comprises two opposed hexagonal flat surfaces 20, 21 and six contiguous edge surfaces 18. The inserts are provided with a clearance angle β, between the upper hexagonal surface 21 and adjacent edge surface 18 which means that the necessary cutting rake is inherently provided on the insert per se, rather than by a particular orientation of the insert relative to the shank. The insert has a centrally provided aperture 17 for receiving a clamp screw.

With this illustrated preferred embodiment as shown in Fig. 1-2 the arrangements are such that the radially inner insert 16 is offset from a 180 degree relationship with the outer insert 15 by an angle α wherein α is of such magnitude that the drill is radially balanced; usually α is in the area of 5°-7°.

Because of the hexagonal shape of the inserts 15 and 16 said inserts will expose a free end profile including a V-shape. There is a pair of straight cutting edges 15a and 15b respectively that represent the operative cutting edges including an obtuse angle γ therebetween whereby each insert is so arranged in its site that the edges 15a and 15b will form the same angle $\gamma/2$ with an imaginary bisector P which extends parallel with the center line CL of the drill.

As shown in Fig. 4 the clearance face 18 of the insert includes two flat surfaces 18a and 18b that intersect at an obtuse angle γ. A planar locating land 19 of triangular shape extends between surfaces 18a, 18b from one hexagonal bottom surface 20 towards the opposite hexagonal upper surface 21 but is terminated at a certain distance from said upper surface 21. This locating land 19 is arranged symmetrically between clearance faces 18a, 18b. This land 19 is sloping such that its angle of inclination β_2 from the upper surface 21 is smaller than the clearance angle β, between the clearance face 18a and said upper surface 21. Hence, said land 19 is forming an edge 22 with only one hexagonal surface, namely the lower hexagonal surface 20. Further, at each cutting corner two adjacent clearance faces 18 meet each other whereby the transition therebetween is a smoothly curved surface 23 which intersects with upper surface 21 at acute angle θ and which is sloped away from the upper rake surface 21 to provide necessary clearance. At a position located at about half the thickness of the insert said curved surface 23 intersects with a bevelled surface 24 which intersects with only the bottom surface 20 at obtuse angle that enables the insert to enter small diameters.

Claims

1. A drill comprising an elongated body terminating at one end in a cutting tip, a pair of diametrically opposite chip flutes extending along the body to the cutting tip a pair of indexable inserts having V-shaped cutting edges at the end of the cutting tip lying at the trailing sides of the chip flutes, each said insert having six contiguous edge faces (18) of equal length and two opposed hexagonal side faces (20, 21), the intersection of said edge faces and one of said hexagonal faces forming cutting edges (15a, 15b), said insert being clamped in pockets at the trailing sides of said chip flutes (13, 14), the edge of one insert extending radially such as to form the wall of the hole to be drilled, the other insert being located radially inwardly of the cutting circle of revolution, said inserts extending axially to generally the same extent, **characterized** in combination, by

a) the inserts (15) and (16) are so arranged that their operative cutting edges form the same equal angle with a bisector (P) of the intermediate corner that extends parallel with the center line (CL) of the drill

b) the inserts (15) and (16) are provided with a clearance angle (β_1) between an upper hexagonal flat surface (21) and an adjacent edge surface (18) and

c) each edge surface (18) is provided with a planar locating land (19) having an angle of inclination (β_2) in relation to the upper flat surface that is smaller than the angle of inclination (β_1) between the edge surface (18) and said upper surface (21).

2. A drill as defined in claim 1, **characterized** in that the planar locating land (19) has triangular shape and intersects with only the lower hexagonal flat surface (20) of the insert.

3. A drill as defined in claim 1, **characterized** in that the end portion of each edge surface (18) at the corner of the insert is in the shape of a smoothly curved convex surface portion (23) which intersects with only the upper hexagonal surface (21) of the insert at an acute angle.

4. A drill as defined in claim 3, **characterized** in that each corner area of the insert has a bevelled land (24) which intersects with only the lower hexagonal surface (20) at an obtuse angle.

5. An indexable cutting insert, said insert having six contiguous edge faces (18) of equal length and two opposed hexagonal side faces (20, 21), the intersection of said edge faces and one of said hexagonal faces forming cutting edges (15a, 15b), **characterized** in combination that

a) the insert (15) is provided with a clearance angle (β_1) between an upper hexagonal flat surface (21) and an adjacent edge surface (18) and

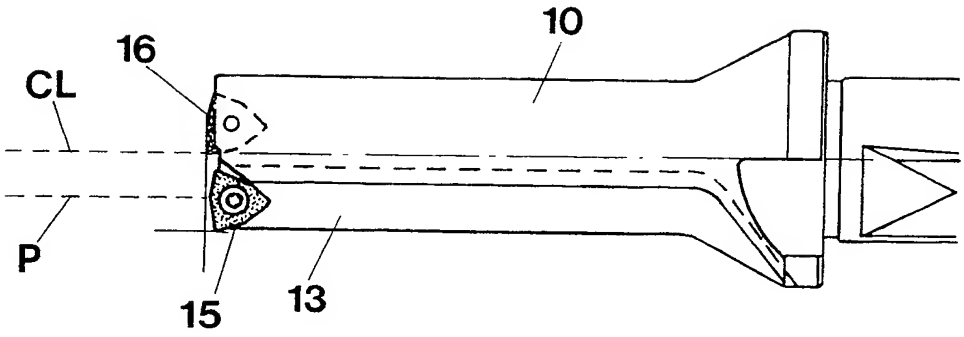
b) each edge surface (18) is provided with a planar locating land (19) having an angle of inclination (β_2) in relation to the upper flat surface that is smaller than the angle of inclination (β_1) between the edge surface (18) and said upper surface (21).

6. An insert as defined in claim 5, **characterized** in that the planar locating land (19) has triangular shape and intersects with only the lower hexagonal flat surface (20) of the insert.

7. An insert as defined in claim 5, **characterized** in that the end portion of each edge surface (18) at the corner of the insert is in the shape of a smoothly curved convex surface portion (23) which intersects with only the upper hexagonal surface (21) of the insert at an acute angle.

8. A drill as defined in claim 7, **characterized** in that each corner area of the insert has a bevelled land (24) which intersects with only the lower hexagonal surface (20) at an obtuse angle.

Fig.1



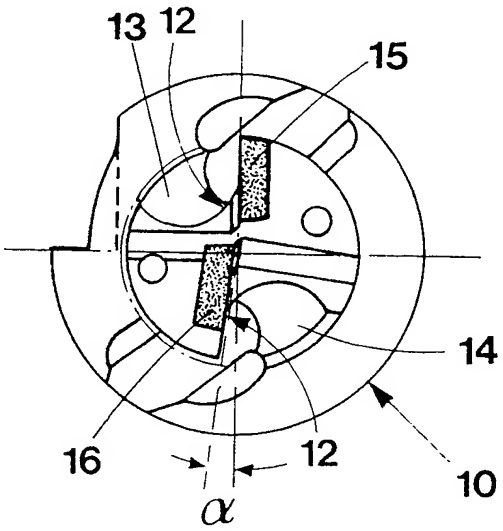


Fig.2

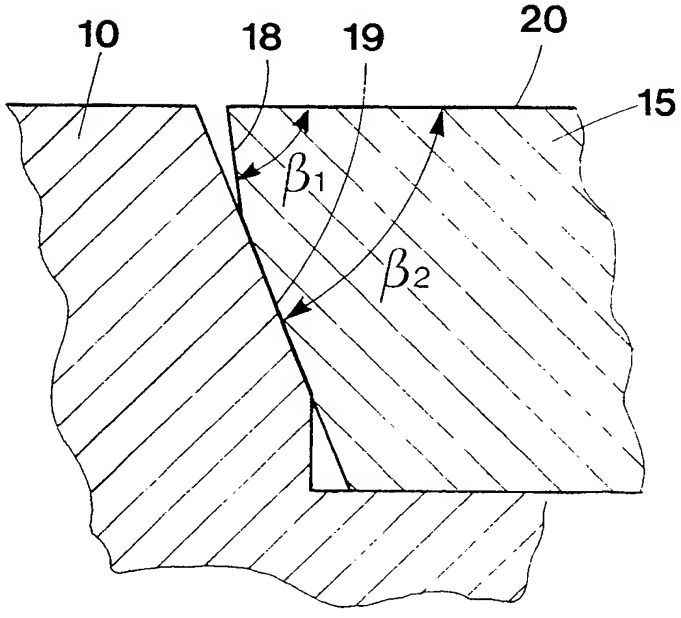


Fig.3

Fig.4

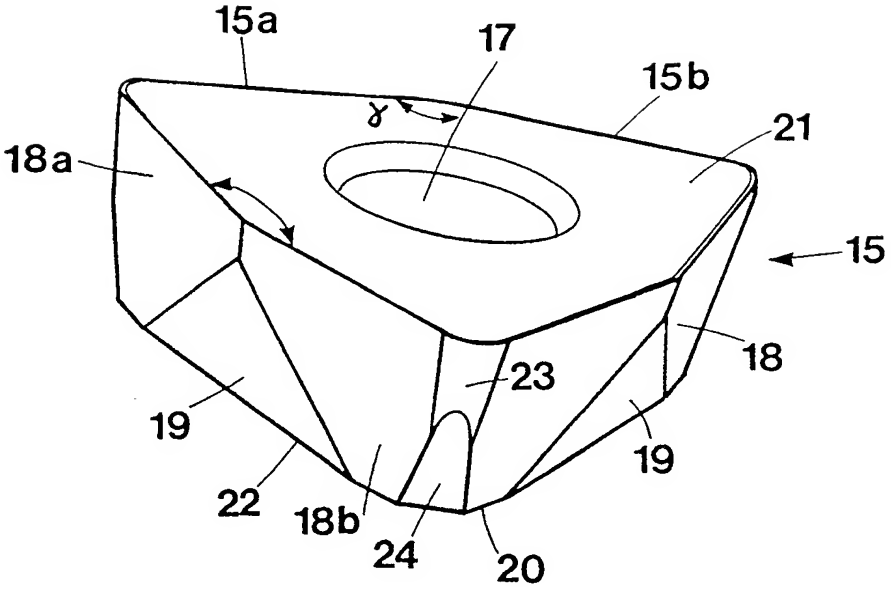
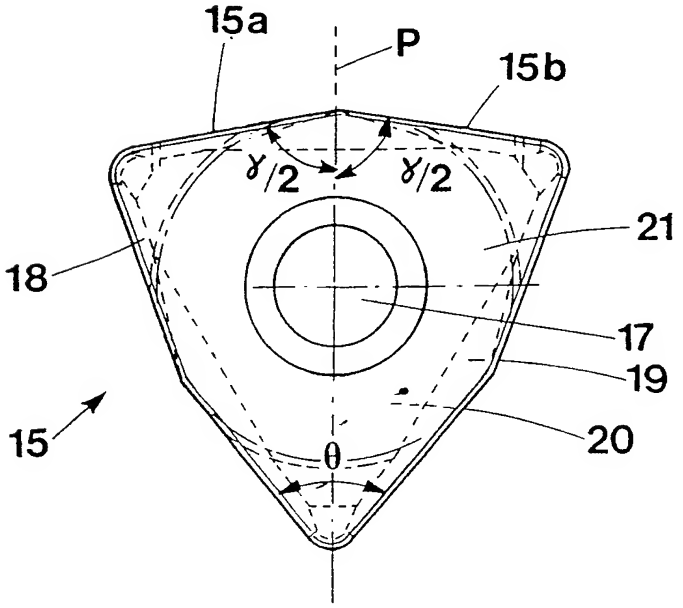

15a
17
15b
γ
21
18a
15
18
23
19
19
22
18b
24
20

Fig.5


15a
P
15b
γ/2
γ/2
21
18
17
19
15
20
θ

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EUROPEAN SEARCH REPORT

Application Number

EP 89 85 0437

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-2581329 (GENNADY YAKOVLEVICH POTEMKIN) * abstract * * page 5, line 8 - page 6, line 23; figures 1, 2 *	1, 3, 5, 7	B23B51/04
A		2, 4, 6, 8	
A	DD-A-206094 (KORN ET AL) * page 4, line 10 - page 6, line 12; figures 1-3 *	1-8	
A,D	US-A-4648760 (KARLSSON ET AL) * abstract; figures 1-6 *	1-8	
A	EP-A-112136 (GENERAL ELECTRIC COMPANY) * page 2, line 12 - page 4, line 3 * * page 11, line 30 - page 13, line 6; figures 2, 4a, 4b *	1, 3, 5, 7	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B23B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	02 AUGUST 1990	CUNY, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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